

**Supplemental Specification  
2005 Standard Specification Book**

**SECTION 02843**

**CRASH CUSHIONS**

**Delete Section 02843 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Furnish and install crash cushions
- B.      Furnish and install crash cushion markings

**1.2      RELATED SECTION**

- A.      Section 02324: Compaction

**1.3      REFERENCES**

- A.      ASTM D 4956: Standard Specification for Retroreflective Sheeting for Traffic Control
- B.      Energite® III Module Systems Design Manual
- C.      NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features
- D.      UDOT Guidelines for Crash Cushions and Barrier End Treatments, current edition

**1.4      SUBMITTALS**

- A.      Installer Certification.
  - 1.      Manufacturer certified installer.
  - 2.      Provide proof of certification prior to installation.

- B. Provide a letter of certification for each system location, affirming that each system is installed according to Department's and the manufacturer's specifications.
  - 1. Reference Project Number and describe Station/location indicating median, left or right shoulder or gore area application.

## **PART 2 PRODUCTS**

### **2.1 CRASH CUSHION**

- A. Select from the current approved products list, UDOT Guidelines for Crash Cushions and Barrier End Treatments.
  - 1. Refer to the current UDOT Guidelines for Crash Cushions and Barrier End Treatments for specific uses and requirements for each approved system type. The UDOT Guidelines for Crash Cushion and Barrier End Treatments is maintained by the Division of Traffic and Safety and available through the UDOT Internet home page. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>.
    - a. Systems tested under NCHRP-350 requirements and a letter of acceptance issued by FHWA.
    - b. Supply three sets of shop drawings and installation drawings for each system type supplied.
      - 1) Distribute drawings to Contractor, installation contractor, and Engineer or designated representative.
  - 2. Refer to CC series Standard Drawings for each approved system type.
- B. Types:
  - 1. Type A: Protect fixed hazards greater than 3 ft wide within 15 ft of traveled way, with less than 100 ft of longitudinal space in front of the hazard.
    - a. Supply system with an adequate width as specified in plan set.
    - b. Supply system for the required speed as per UDOT's Guidelines for Crash Cushions and Barrier End Treatments, current edition.
    - c. Galvanize all steel parts as per manufacturer's requirements.
    - d. Supply transition element, for the approach of opposing traffic, when system is installed with bi-directional traffic and the system is within 1.2 times the required minimum clear zone.
      - 1) Two transition elements required when system is installed with w-beam median barrier.
    - e. Install system on concrete pad as per manufacturer's requirements.
    - f. Supply crash cushion markings as per CC series Standard Drawings.

2. Type B: To protect fixed hazards up to 3 ft wide or less and within 15 ft of traveled way, with less than 100 ft of longitudinal space in front of the hazard.
  - a. Supply system with an adequate width as specified in plan set.
  - b. Supply system(s) for the required speed as per UDOT's Guidelines for Crash Cushions and Barrier End Treatments, current edition.
  - c. Galvanize all steel parts as per manufacturer's requirements.
  - d. Supply transition element, for the approach of opposing traffic, when system is installed with bi-directional traffic and the system is within 1.2 times the required minimum clear zone.
    - 1) Two transition elements required when system is installed with w-beam median barrier.
  - e. Install system on concrete pad as per manufacturer's requirements.
  - f. Supply crash cushion markings as per CC series Standard Drawings.
3. Type C: To protect fixed objects 3 ft wide or less within 15 ft of traveled way, and longitudinal space in front of the hazard greater than 100 ft.
  - a. Galvanize all steel parts as per manufacturer's requirements.
  - b. Supply double-sided w-beam transition element when system is installed in conjunction with concrete barrier or bridge parapet.
  - c. Supply crash cushion markings as per CC series Standard Drawings.
4. Type D: To protect fixed hazards within 15 ft of traveled way. Use in areas where one impact per year is anticipated or when repair history indicates two or more impacts over a three-year period.
  - a. Supply system with an adequate width as specified in plan set.
  - b. Supply system for the required speed as per UDOT's Guidelines for Crash Cushions and Barrier End Treatments, current edition.
  - c. Galvanize all steel parts as per manufacturer's requirements.
  - d. Supply transition element, for the approach of opposing traffic, when system is installed with bi-directional traffic and the system is within 1.2 times the required minimum clear zone.
    - 1) Two transition elements required when system is installed with w-beam median barrier.
  - e. Install system on concrete pad as per manufacturer's requirements.
  - f. Supply crash cushion markings as per CC series Standard Drawings.
5. Type E - Sand Barrel Arrays: To protect fixed hazards outside of 15 ft from the traveled way and there is an unlimited amount of space. Refer to the UDOT Guidelines for Crash Cushion and Barrier End Treatments for specific uses and requirements of sand barrel arrays.
  - a. Design sand barrel array using Energite® III Module Systems design manual.
    - 1) Design sand barrel array to meet roadway design speed.
  - b. Certify sand barrels and components meet NCHRP-350 for non-redirective, gating crash cushions.

- c. Construct sand barrels using a frangible polyethylene material that will shatter upon impact.
    - 1) Use yellow sand barrels.
    - 2) Permanently apply manufactured date, month, and year to each piece of the barrel system.
    - 3) Use one or two-piece barrel construction.
    - 4) Interface cones with the barrel to prevent leakage of sand but allow for the drainage of excess water for sand barrel systems that use barrel and cone configuration.
    - 5) Provide lids for each sand barrel. Fasten lid securely to barrel.
  - d. Provide sand barrels that hold the required amounts of sand as per requirements of the typical sand barrel array.
    - 1) 200 lb, 400 lb, 700 lb, 1400 lb, and 2100 lb.
    - 2) Mark each barrel in a manner that the amount of sand required for the nominal weight is visible for systems that are designed using barrels for multiple sand weight requirements.
  - e. Use dry sand to fill modules, 2 percent or less moisture.
  - f. Supply crash cushion markings and construct pad as per CC series Standard Drawings.
6. Type F: Use to protect concrete barrier or bridge parapets with less than 150 ft of longitudinal space in front of the hazard. Used in a unidirectional application.
- a. Galvanize all steel parts as per manufacturer's requirements.
  - b. Install system on concrete pad, when specified by manufacturer, and to the manufacturer's specifications.
  - c. Supply crash cushion markings as per CC series Standard Drawings.
7. Type G: Use to protect the approach end of single face w-beam guardrail or approach ends of bridge parapet and concrete barrier with unlimited longitudinal space (greater than 125 ft) in front of the hazard in a unidirectional application, and is installed where a tangent system is desired. W-beam transition element is required when system is installed at the end of bridge parapet or the end of concrete barrier.
- a. Supply post option as described in UDOT Guidelines for Crash Cushion and Barrier End Treatments, current edition.
  - b. Supply system with 12-½ ft galvanized w-beam rail elements as per manufacturer's requirements.
  - c. Supply manufacturer approved impact head and hardware.
  - d. Galvanize all steel parts as per manufacturer's requirements.
  - e. Supply crash cushion markings as per CC series Standard Drawings.

8. Type H: Use to protect the approach end of single face w-beam guardrail or approach end of bridge parapet and concrete barrier with unlimited longitudinal space (greater than 125 ft) in front of the hazard in a unidirectional application, and is installed where a flared system is desired. W-beam transition element is required when system is installed at the end of a bridge parapet or the end of concrete barrier.
  - a. Supply post option as described in UDOT Guidelines for Crash Cushion and Barrier End Treatments current edition.
  - b. Supply system with 12-½ ft galvanized w-beam rail elements as per to manufacturer's requirements.
  - c. Supply manufacturer approved impact head or end section and hardware.
  - d. Galvanize all steel parts as per manufacturer's requirements.
  - e. Supply crash cushion markings as per CC series Standard Drawings.

## **2.2 CRASH CUSHION MARKINGS**

- A. Marker plate: Per CC series Standard Drawings.
  1. Construct marker plate 18 inches x 18 inches using 0.032-gage aluminum with appropriate object marker sheeting.
    - a. Drill a 7/16-inch hole in each corner of plate.
    - b. Use ASTM D 4956 Type III sheeting with encapsulated glass bead retroreflective material, or greater. Use appropriate sheeting type for the substrate sheeting is placed on.
    - c. Use a 24 inch x 14 inch object marker plate or self-adhesive object marker sheeting ASTM D 4956 Type III sheeting with encapsulated glass bead retroreflective material, or greater for Type C systems. Use appropriate sheeting type for the substrate sheeting is placed on.
    - d. Substitution of self-adhesive object marker sheeting ASTM D 4956 Type III sheeting with encapsulated glass bead retroreflective material, or greater, 18 inches x 18 inches or 24 inches x 14 inches placed directly on system for Marker Plate is acceptable.
    - e. Accept object markers supplied by the manufacturer that exceed the above requirements.
- B. Marker Post: Per CC series Standard Drawings
  1. Construct marker post, 60 inches long and 2 inches OD, using black polyethylene material.
    - a. Close top of marker post.
    - b. Drill three 7/16-inch mounting holes.
    - c. Apply three 4-inch bands of yellow sheeting ASTM D 4956 Type III sheeting with encapsulated glass bead retroreflective material, or greater.

## **PART 3      EXECUTION**

### **3.1      INSTALLATION**

- A.    Prepare site to finished grade prior to installation of crash cushion or barrier end treatment.
  - 1.    Construct approach areas and recovery areas to meet UDOT Standards and system requirements prior to installation of system.
    - a.    Refer to CC series Standard Drawings for system requirements.
  - 2.    Construct concrete pad, when applicable, to meet system requirements.
    - a.    Use manufactures specification for concrete pad construction.
    - b.    Refer to CC series Standard Drawings for Type E - sand barrel detail, for pad requirements.
  - 3.    Obtain Engineer's approval of site grading, approach and recovery areas, and layout, prior to system installation.
  - 4.    Compact backfill material around posts and foundation tubes to minimum 96 percent of maximum laboratory density and dispose of excess material. Refer to Section 02324.
- B.    Install in accordance with:
  - 1.    UDOT Guidelines for Crash Cushion and Barrier End Treatments.
  - 2.    Manufacturer's specifications and recommendations.
  - 3.    Use manufacturer certified installer to perform the installation.
- C.    Complete repair or replacement of any crash cushion damaged during construction within 24 hours of notification of damage.
  - 1.    Contractor is responsible for the cost of repair or replacement of any permanent system damaged for any reason until final acceptance.
    - a.    Exception:
      - 1)    Damage is caused by an errant vehicle, AND
      - 2)    Damage occurs after Traffic has been established in the final lane configuration with shoulders as established in the project plans.
    - b.    Payment will be made using a Force Account basis for the cost of repair or replacement of the damaged system when the Engineer determines the conditions described under the exception above apply.

END OF SECTION